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(1 December 1964 through 28 February 1965), Transmittal of

Encl: Third Quarterly Progress Report on Contract Nonr-3579(04)

Defense Research Laboratory is pleased to submit the enclosure as a report of progress made during the period 1 December 1964 through 28 February 1965 on Contract Nonr-3579(04).

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Report for Contract Nonr-3579(04)
for the period 1 December 1964 through 28 February 1965
Supported by Contract R-129-09-030-017 with the National Aeronautics
and Space Administration

by

Lloyd A. Jeffress and Charles S. Watson

Status of Proposed Problems

A. Problem 1. Receiver Operating Characteristics for Visual Detection

Work on this problem is underway. The stimulus being employed in one of the experiments is a simulated A-scan on an oscilloscope. Both the noise and the signal appear as y-axis deflections on the scan. The noise is continuous across the scope, and the signal, which is either present or absent with an a priori probability of 0.5, occupies a designated space near the center of the screen. The subject's task is to indicate by means of the rating-scale device his degree of certainty that a signal was present during the scan. A variety of signal-to-noise ratios have been employed and ROC curves determined. The underlying probability density functions appear to be different from any so far encountered in detection experiments. The ROC curves show a decided asymmetry and a sharp bend when plotted on normal-normal probability paper. The bend is much more pronounced than that encountered with auditory data. Work on the problem is continuing.

A related study is being instrumented in the neurophysiological laboratory of the Department of Psychology. It will involve the detection of brightness increments and decrements in a visual display for various adaptation levels for the surrounding field. It is planned to correlate the psychophysical findings with neurophysiological data obtained from single-unit responses from the lateral geniculated body of animals. Dr. Jacobs, who is conducting this phase of the study, already has considerable data from the LGN, gathered while he was working at Indiana University. This work will be continued and extended to parallel the psychophysical studies.

B. Problem 2. Signal Detection as a Function of Vigilance

Work on one phase of this problem was reported in the last status report. Work on another phase involving the recording of galvanic skin responses during the vigilance trials is being instrumented.

C. Problem 3. Signal Duration and the Width of Critical Bands

Work specifically on the effect of duration is being deferred as stated in the last report until more is learned about the effect upon detection of narrowing the bandwidth of the masking noise. Work already completed is showing that the bandwidth employed by the ears in detecting a monaural or diotic stimulus is considerably narrower than that employed in detecting a signal which has been reversed in phase at one ear relative to the other, the stimulus condition commonly referred to in the literature as NO S π . The effect of band narrowing under the two stimulus conditions is being studied, prior to attempting to determine the interaction effects of changing the signal duration as well.

D. Problem 4. Detection of Minimal Signals in the Absence of External Noise

Work on this problem has involved a study of the appropriate psychophysical method to be employed. This study has been completed and shows that it is possible to employ, without serious interaction effects, a two-interval, forced-choice procedure using four different signal levels randomly ordered. This makes it possible to obtain the desired data with a considerable saving in the time required to complete the final study.

E. Problem 5. Detection by Multiple Observers

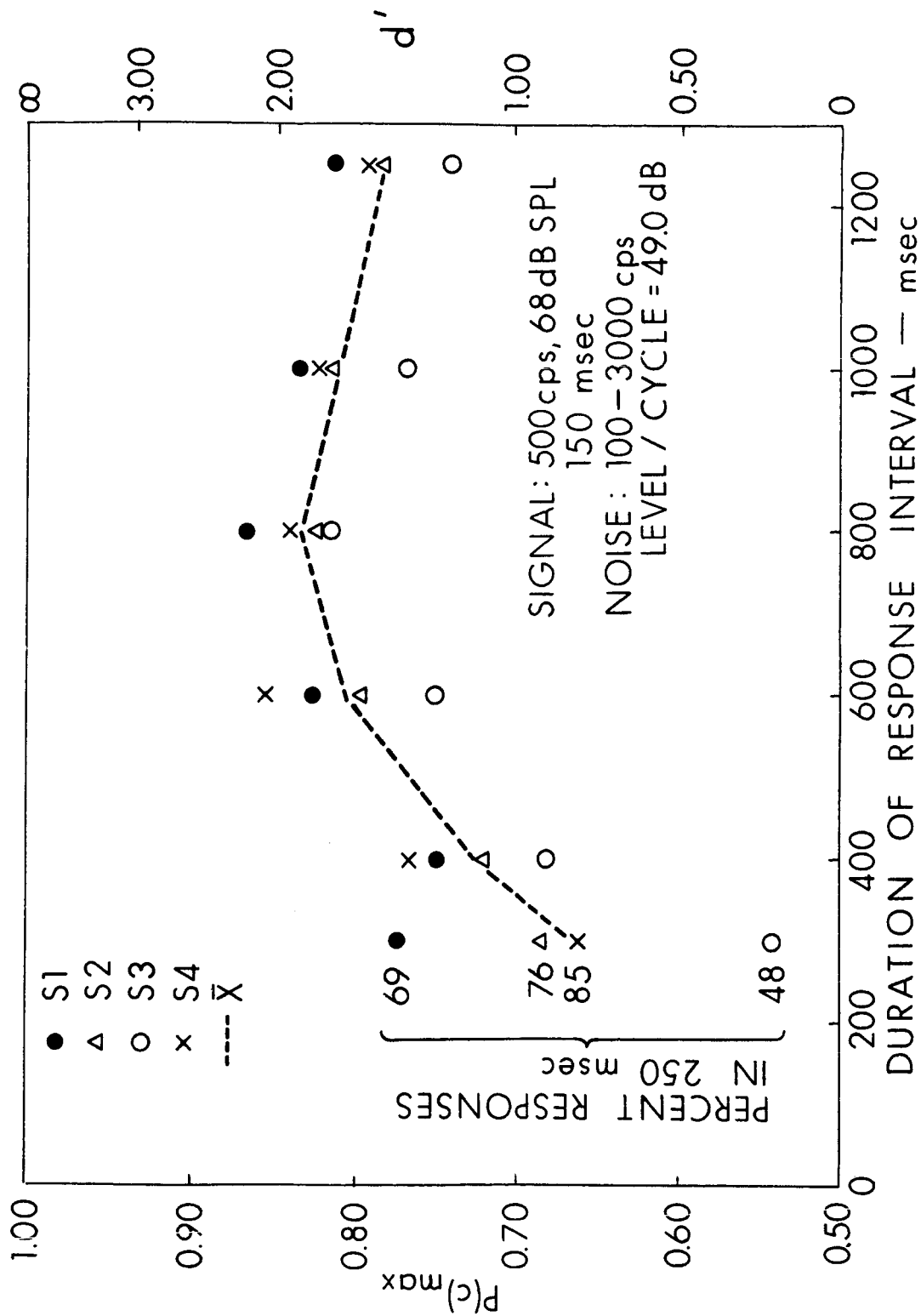
As mentioned in earlier reports, data on this problem are being gathered concurrently with data for other problems where four subjects are

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employed at a time. The findings continue to indicate that the "multiple observer" performs better than the best of the four being used during a sitting.

F. Problem 6. Detection and Response Latency

Collection and analysis of data was completed during this period for the first phase of the reaction-time detection experiments. The results describe the minimal response periods required for simple (yes-no) responses when faint tonal signals are to be detected in a Gaussian noise background. Drawing AS-65-595-S shows the data for four subjects. Since the procedure involved shortening the response interval after approximately each 2000 trials, these results are confounded with possible learned effects. In particular, we cannot describe the maximum performance for the 800-msec response interval as optimal. However, other research has shown learning to be essentially complete in similar detection tasks after a single listening session; eight such sessions were completed before these data were collected. It is clear that as little as 800 msec may be allotted in which to decide whether the tonal signal was present or not and to perform a manipulative (key-pressing) response, without significant decrement in detection level. Some decay in detection level is found for response intervals of 600 and 400 msec, and observers cannot make responses in as little as 250 msec without considerable sacrifice in performance.



$P(c)_{\max}$ AS A FUNCTION OF DURATION OF RESPONSE INTERVAL

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